Unit Rate and Unit Analysis

TAKE OUT A CALCULATOR!

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Rate

A ratio that compares two quantities with **different units** of measure is called a **rate**.

Examples: $23 per foot

55 mph

$5/ per person

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Rate

$$\frac{500 \text{ mi.}}{10 \text{ hr.}} = 50 \text{ mi./hr.}$$

A comparison of a number to one in **different units**.

Always written as a **single number** on a per unit basis.

Read 85.9 words/min.

2 pets/per family

Always write the **units**. **Divide** to simplify.

Unit Rate

A **unit rate** when you have a **denominator of 1**

Your family drove 200 miles. The total amount of fuel used was 10 gallons of gas.

What was the **average rate** of **fuel consumption**?

$$\frac{\text{miles}}{\text{gallons}} \quad \frac{200 \text{ miles}}{10 \text{ gallons}} = \frac{20 \text{ miles}}{1 \text{ gallon}}$$

Unit Rate

Rates are simplified by writing them as a **unit rate**. A **unit rate** has a second term that is a **single unit**.

Example: 500 people go to 10 school dances.

$$\frac{500 \text{ people}}{10 \text{ dances}} = \frac{50 \text{ people}}{1 \text{ dance}}$$

Unit Rate

Find the Unit Rate. Amount per one

1) **150 students in 5 classrooms**

$$\frac{150 \text{ students}}{5 \text{ classrooms}} = 30 \text{ students / classroom}$$

Unit Rate

Find the Unit Rate. Amount per one

2) **$24 for 8 lunches**

$$\frac{\$24}{8 \text{ lunches}} = \$3.00 / \text{lunch}$$

Unit Rate

Find the Unit Price. Amount per one

$200 for 4 skateboards

$$\frac{\$200}{4 \text{ skateboards}} = \$50 \text{ / per skateboard}$$

Unit Analysis

To convert a rate you must use a common unit.
You multiply by a **common measurement**.

Change to minutes

Common Measurement

$$\frac{2 \text{ hours}}{30 \text{ minutes}} \times \frac{60 \text{ minutes}}{1 \text{ hour}} = \frac{120}{30} = \frac{4}{1}$$

Change to inches

Common Measurement

$$\frac{2 \text{ yards}}{8 \text{ inches}} \times \frac{36 \text{ inches}}{1 \text{ yard}} = \frac{72}{8} = \frac{9}{1}$$

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Unit Analysis

Change 3 hours to **minutes**

$$\frac{3 \text{ hours}}{1} \cdot \frac{60 \text{ min.}}{1 \text{ hr}} = 180 \text{ min.}$$

Change 21 days to **weeks**

$$\frac{21 \text{ days}}{1} \cdot \frac{1 \text{ week}}{7 \text{ days}} = \frac{21}{7} = 3 \text{ wks}$$

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Unit Analysis

Change 4 pounds to **ounces**

$$\frac{4 \text{ pounds}}{1} \cdot \frac{16 \text{ oz.}}{1 \text{ lb}} = 64 \text{ oz.}$$

Change 10 feet to **inches**

$$\frac{10 \text{ ft}}{1} \cdot \frac{12 \text{ in.}}{1 \text{ ft}} = 120 \text{ in.}$$

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Unit Analysis

Change 6 feet to **inches**

$$\frac{6 \text{ ft}}{1} \cdot \frac{12 \text{ in.}}{1 \text{ ft}} = 72 \text{ in.}$$

Change 5 hours to **minutes**

$$\frac{5 \text{ hours}}{1} \cdot \frac{60 \text{ min.}}{1 \text{ hr}} = 300 \text{ min.}$$

Change 49 days to **weeks**

$$\frac{49 \text{ days}}{1} \cdot \frac{1 \text{ week}}{7 \text{ days}} = \frac{49}{7} = 7 \text{ wks}$$

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Unit Analysis

Your heart beats **70 beats/min**. How many **beats per hour** is this?

Start **Finish**

$$\frac{70 \text{ beats}}{1 \cancel{\text{ min.}}} \times \frac{60 \cancel{\text{ min.}}}{1 \text{ hr.}} = \frac{4200}{1} \frac{\text{beats}}{\text{hr.}}$$

Rate

$$\frac{60 \text{ min.}}{1 \text{ hr.}}$$

4200 beats / hr.

Missing Units

Write the **statement as a fraction**. Then **find the missing unit**.

$$\frac{8 \text{ lb}}{1 \text{ ft}^3} \bullet 5 \text{ ft}^3 = 40 \text{ lb}$$

$$\frac{? \cancel{\text{ lb}}}{1 \cancel{\text{ ft}^3}} \bullet \frac{5 \cancel{\text{ ft}^3}}{1} = 40 \cancel{\text{ lb}}$$

$$? \bullet 5 = 40$$

The missing number is 8.

Missing Units

Write the **statement as a fraction**. Then **find the missing unit**.

$$\frac{5g}{1cm^3} \bullet 10\ \underline{?} = 50g$$

$$\frac{5g}{1cm^3} \bullet \frac{10?}{1} = 50g$$

Your units must cancel.

The missing unit is cm^3.

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Missing Units

Write the **statement as a fraction**. Then **find the missing unit**.

$$3h \bullet \frac{20\ km}{?} = 60km$$

$$\frac{3h}{1} \bullet \frac{20\ km}{?} = 60km$$

Your units must cancel.

The missing unit is 1 hr.

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Unit Analysis

An airplane flies 590 miles per hour for 120 minutes. How many miles does it travel?

SOLUTION

First make sure that the units for the rate and the time are compatible. In this case, convert minutes to hours.

Start → Finish

$$\frac{120 \text{ mins}}{1} \times \frac{1 \text{ hour}}{60 \text{ mins}} = \frac{120}{60} = 2 \text{ hours}$$

Rate $\frac{1 \text{ hour}}{60 \text{ mins}}$

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Unit Analysis

An airplane flies 590 miles per hour for 120 minutes. How many miles does it travel?

120min = 2hrs

Then calculate the distance traveled.

$$D = r \bullet t$$

$$D = \frac{590 \text{ miles}}{1 \text{ hour}} \bullet 2 \text{ hours}$$

$$D = 1180 \text{ miles}$$

The plane travels 1180 **miles** in 120 **minutes**.

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Unit Analysis

That's all Folks!

Take out your Study Guide!

#17 Unit Rate as a Fraction

Unit Rate is a comparison of a number to one in different units. It is written as a fraction. You **divide to simplify** and **always include units** in your answer.

1) **120 students in 4 classrooms**

$$\frac{120 \text{ students}}{4 \text{ classrooms}} \quad \frac{\div 4}{\div 4} \quad = \quad \frac{30 \text{ students}}{1 \text{ classroom}}$$

2) **29 grams per cubic centimeter**

$$\frac{29 \text{ grams}}{1 \text{cm}^3}$$

Unit Rate is a rate that is reduced to **1 unit**

#18 Find the Missing Unit

Write the statement as a fraction. Then find the missing unit.

1) $\frac{?\ \text{lb}}{1\ \text{ft}^3} \bullet 6\ \text{ft}^3 = 30\ \text{lb}$

$\frac{?\ \cancel{\text{lb}}}{1\ \cancel{\text{ft}^3}} \bullet \frac{6\cancel{\text{ft}^3}}{1} = 30\ \cancel{\text{lb}}$

$? \bullet 6 = 30$

The missing number is 5.

2) $\frac{4\text{g}}{1\text{cm}^3} \bullet 8\ ? = 32\text{g}$

$\frac{4\cancel{\text{g}}}{1\text{cm}^3} \bullet \frac{8?}{1} = 32\cancel{\text{g}}$

Your units must cancel.

The missing unit is cm^3.